that contains a small amount of lossy magnetic material to further achieve the reduction of electromagnetic interference.--

--20. (new) The method of claim 17, where the lossy magnetic material substantially surrounds the one of the plurality of conductors at the portion of such one conductor relatively near to the wafer.--

REMARKS

Pursuant to the requirement in the Notice to File Missing Parts, Applicant is attaching to the Response to the Notice to File Missing Parts, substitute pages 7, 8, and 9 of the specification, and is including in the Response the statement that the replacement pages 7, 8, and 9 contain no new matter.

THE NEW METHOD CLAIMS 11-20

It is noted that the Huang Patent 5,138,431 is concerned with a composite leadframe structure as shown in FIGS. 6A - 6G where part of the leadframe structure is of electrically conducting ferromagnetic material which is used because of its great tensile strength, rigidity, and thermal coefficient of expansion matching silicon (Huang, col.1, lines 54 - 60).

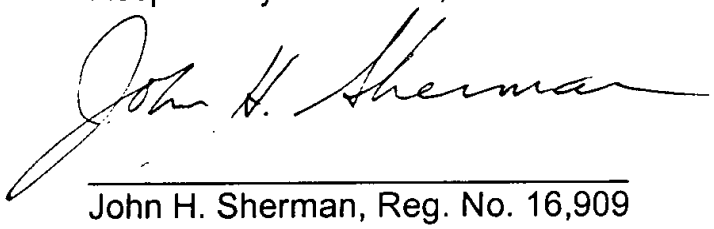
The magnetic characteristic of the composite leadframe apparently is a detriment, so that Huang uses a thick copper e.g. 22', FIG. 6A, to shunt current away from the conductive ferromagnetic material 22", FIG. 6A.

One of ordinary skill in the art would avoid adding magnetic material in the vicinity of a leadframe since this is directly contrary to the teaching of Huang who seeks to reduce the effects of ferromagnetic material in his leadframe.

CONCLUSION

An earnest effort has been made to point out that one of ordinary skill in the art would not arrive at the inventions herein claimed from the teachings of Huang which teachings point away from the present inventions, and accordingly, a favorable consideration of new claims 11 - 20 is courteously solicited.

Respectfully submitted,



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Enclosures: (1) Petition for Three-Month Extension of Time

(2) Unsigned Copy of Petition for Acceptance of an Unintentionally Delayed Claim for Priority Pursuant to 37 CFR 1.78 (a)(3) and (a)(6), without Enclosures (for information only)

permeability of the surrounding material 14 that is not too high to cause significant mutual coupling but yet sufficient to desirably affect the series inductance of the lead conductors 16. In a preferred embodiment of the present invention, the relative permittivity of the encapsulating medium 14 ranges from 5 to 10.

Regarding the two conductor mutual coupling example as shown in FIG. 3, the actual amount of mutual inductance M_F between two adjacent lead conductors 16A and 16B is small with respect to the self-inductance L_F of each conductor 16. In a preferred embodiment of the present invention, the reduction of crosstalk on any particular conductor 16 may be further achieved by placing that particular lead conductor 16 adjacent to a V_{CC} or V_{GND} lead to avoid any coupling to another data signal path.

FIG. 6 illustrates a preferred embodiment of the present invention in which mutual coupling between adjacent leads is eliminated. The virtual elimination of the mutual inductance may be achieved by molding the device package 10 in two steps. The first step preferably comprises constructing the lead frame 16 and then forming or molding individual ferrite "microbeads" 30 on each lead 16. The microbeads 30 are preferably offset so they do not interfere with adjacent microbeads 30. The microbeads 30 are electrically isolated from the adjacent conductors 16.

In a preferred embodiment of the present invention the microbeads 30 are made of pure ferrite material which may be constructed using known ceramic techniques, and the microbeads 30 would be formed as an integral part of the lead frame 16. The microbeads 30 are utilized in a manner analogous to the utilization of ferrite bead chokes in radio-frequency transmission lines and antennas. The bead surrounds the transmission line and effectively chokes undesired high frequency signals immediately external to the transmission line that are the source of electromagnetic interference without affecting data signals passing therethrough.

The second step preferably comprises ordinary plastic encapsulation of the frame 16 and the integrated circuit 12 upon completion of the bonding and wiring of the IC 12 to the lead frame 16. In an alternative embodiment of the present invention the inclusion of a ferrite microbead 30 on any given lead 16 is optional depending upon the type of signal transmitted thereon. For example, V_{CC} and V_{GND} signals perform better if there is no ferrite bead 30 on those leads. In a preferred embodiment, the standard lead frame 16 is constructed with a microbead 30 on each lead 16. Microbeads 16 may be selectively removed by crushing away the undesired beads 30 which is facilitated by the inherent brittleness of ferrite. Preferably, a simple press may be utilized having small crushing pins arranged above the corresponding microbeads to be crushed in which all undesired microbeads 30 may be removed in a single step.

FIG. 7 illustrates a preferred embodiment of the present invention in which the magnetic flux is contained within the ferrite beads. The ferrite bead 30 surrounding conductor lead 16A completely contains the magnetic flux 32 generated by the current flowing into conductor lead 16A. Thus, no current is induced in conductor lead 16B from the magnetic flux 32 created by the current flowing through conductor lead 16A. In a preferred embodiment of the present invention, only the microbeads 30 contain ferrite wherein the encapsulating medium 14 entirely comprises non-magnetic plastic. Alternatively, a small amount of ferrite may be blended in with the encapsulating plastic 14 in conjunction with the utilization of ferrite beads to further achieve the reduction of electromagnetic interference.

FIG. 8 illustrates the preferred placement of the ferrite beads of the present invention relative to the integrated circuit wafer in the device package. The most effective physical location for the microbeads 30 is as near to the integrated circuit 12 as possible. With the required close spacing of the lead frame conductors 16 near the IC bonding pads 20, the physical size of a microbead 30 may not be very large, however the effects of the reduce size are

offset by the fact that the placement of the ferrite microbead 30 near the IC 12 is nearly ideal.

FIG. 9 illustrates the resulting electrical circuit model of a given conductor path in an integrated circuit device package of the present invention. An output signal V_{OUT} from the integrated circuit 12 feeds into an output buffer 24 which is externally connected through an IC bonding wire pad 20. The bonding wire 20 exhibits a small series inductance L_B which is small relative to the inductance L_F of the ferrite microbead 30. The lead frame conductor 16 exhibits a characteristic lumped series inductance L_{OUT} and shunt capacitance C_{OUT}, the effects of which are negligible compared to the inductance L_F of the microbead 30, and extends through the encapsulating medium 14. The effects of inductance L_{OUT} and capacitance C_{OUT} may be further reduced by the blending of ferrite with the encapsulation material 14. The lead frame conductor 16 connects to an external pin 18 on the exterior of the device package 10.

In view of the above detailed description of a preferred embodiment and modifications thereof, various other modifications will now become apparent to those skilled in the art. The contemplation of the invention below encompasses the disclosed embodiments and all reasonable modifications and variations without departing from the spirit and scope of the invention.